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## Economic Impact of West Nile Virus on the Colorado and Nebraska Equine Industries: 2002

### Background

West Nile virus (WNV) affects primarily equids (horses, donkeys, mules, and ponies), birds, and humans. The virus is spread by mosquitoes and results in encephalitis or inflammation of the brain. In equids, WNV produces a varied clinical picture, with some animals experiencing short-lived neurological problems and others suffering from fatal encephalitis. Since it was first recognized in New York in 1999, WNV has spread rapidly across the United States (Figure 1). In 2002, some States reported over 1,000 laboratory confirmed WNV equine cases. Colorado reported 378 and Nebraska 1,100 WNV equine cases in 2002. However, the actual numbers of WNV cases likely exceeded those reported, since many cases of equine WNV were not confirmed in a laboratory.

**Figure 1. Number of Laboratory Confirmed Equine WNV Cases by State in 2002, as Reported USDA:APHIS:VS<sup>1</sup>**



### Objectives

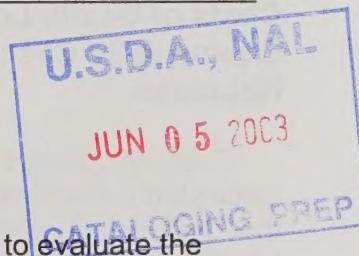
The purpose of this report is to evaluate the economic impact of WNV on the Colorado and Nebraska equine industries in 2002. Determining the economic impact of disease is important for prioritizing research and management and control efforts. To date, no comprehensive national or regional estimate of WNV's economic impact on the United States equine industry has been published.

To fully understand the economic impact of WNV infections in equids, it is important to consider variables beyond the cost of treating the disease, such as: the cost of not being able to use the equid during its illness and recovery (lost-use); and the cost of disease prevention, e.g., vaccination and mosquito mitigation.

### Methods

Information regarding confirmed equine WNV infections was obtained from the Nebraska and Colorado State Veterinarians. From the contact information, 819 equine owners were randomly selected to participate in the survey, 536 of which were successfully contacted by telephone between September 20, 2002, and January 31, 2003<sup>2</sup>. Among these 536 owners, 493 agreed to participate. The survey focused on the WNV vaccination status of affected animals, observed clinical signs, recovery, treatments, and prevention measures. Data gathered from the survey were combined with equid population and sales value estimates from the USDA's National Agricultural Statistics Service (NASS) and the estimated cost of equid care from the American Horse Council (AHC).<sup>3, 4, 5</sup>

A second survey was mailed to 824 veterinarians (503 from Colorado and 321 from Nebraska) who might have seen equine cases in 2002, based on a listing with the American Veterinary Medical Association. A total of 248 veterinarians responded to this survey. Of these, 140 reported seeing at least one case of equine WNV in 2002 and completed the entire survey. This



survey focused on the number of equine WNV cases seen, treatments administered, and treatment costs.

## Costs of Death, Lost-use, and Treatment of Equine WNV Cases in Colorado and Nebraska

Economic impact associated with death was calculated using the estimated number of equids that died or were euthanized because of WNV infection multiplied by the average sales value of an equid in Colorado and Nebraska in 1998. Using this value assumes that this health condition is distributed equally across the equine population, without regard to the value of any specific animal. If higher valued equids are over-represented in the diseased population, the estimated cost associated with death presented in this report would be conservative.

The case fatality rate for the 1,478 equine WNV cases in Colorado and Nebraska combined was estimated using the data from the survey of owners with equine WNV cases. Survey data indicated that approximately 29 percent of equids infected with WNV in the two States died or were euthanized in 2002. Extrapolating to all equids with documented infections suggests that an estimated 423 equids died or were euthanized in Colorado and Nebraska in 2002 as a result of WNV infection.

The average value of equids was calculated by dividing the value of total sales of equids for 1998 by the number of equid sales in Colorado and Nebraska for the same year. The calculated average value of equids sold in 1998 was \$1,615 and \$1,225 for Colorado and Nebraska, respectively, or an average value of \$1,420 for each equid sold in these two States. Thus, the cost attributed to death or euthanasia of 423 equine WNV cases in Colorado and Nebraska for 2002 is estimated to be \$600,660.

The number of days of lost-use for equids that recovered from WNV infection also was estimated using data collected from owners. Approximately 82 percent (276/338) of surviving equid WNV cases investigated in Colorado and Nebraska were considered fully recovered at the time of the interview. Interviews occurred at least 30 days post laboratory confirmation of the animals' disease. Value of lost-use was calculated using the average number of days of lost-use for each equid multiplied by the estimated value of this lost-use.

The value of lost-use was estimated using the average sale value of an equid (\$1,420) divided by the number of days of life expectancy adjusted to current dollars and the weighted average cost of maintaining an equid during the period of lost-use. The average life expectancy for equids was assumed to be 20 years. Again, using the average sales value assumes that the value associated with lost-use is distributed equally across the equine population, without regard to the value of one specific animal.

The average number of days of lost-use at the time of owner interviews for equids infected with WNV in 2002 was 22 days. The cost of lost-use attributed to WNV for the 862 equids that recovered (by an average of 22 days after diagnosis) totaled \$163,659 or \$8.63 per equid, per day. If it were possible to include an estimate of the lost-use for the equids that had not recovered by 30 days of diagnosis, the cost of lost-use would increase.

Combining the description of clinical signs from the survey of owners with the categorical descriptions of mild, moderate, and severe cases established in the veterinarian survey, it was determined that out of 480 WNV cases 8 percent were mild, 58 percent were moderate, and 34 percent were severe. Mild cases were defined as equids exhibiting lethargy, decreased appetite, muscle twitches, and mild lameness, but which required minimal nursing care. Moderate cases were equids exhibiting wobbly gait, difficulty eating, signs of colic, reluctance to move, hyper sensitivity to noise and touch, altered awareness, and requiring more intensive veterinary management. Severe cases were equids that were recumbent, unable to rise, or were exhibiting dog-sitting, "praying" posture, seizures, or headpressing. These equids required extensive and continued nursing care during the duration of their illness.

In conjunction with these descriptions, veterinarians were asked to estimate the cost of treatment for mild, moderate, and severe cases. The cost of treatment derived from the midpoint of the most frequently chosen cost range was used to provide a conservative estimate: approximately \$200 for mild cases; \$400 for moderate cases; and \$250 for severe cases. The discrepancy in the cost of treatment for severe cases compared to moderate cases lies in the fact that many equids with severe cases were likely euthanized before significant treatment costs could accrue. For the 1,478 cases of equine WNV in Colorado and

Nebraska in 2002, the estimated cost of treating mild, moderate, and severe cases totaled \$490,844.

## Prevention

A WNV vaccine became available for equids in summer 2001. The vaccine was developed to aid in the prevention of WNV infection. It is recommended that equids initially be given two doses at 3 to 6 week intervals, followed by an annual booster. The cost of the two initial WNV vaccines (\$50) was derived from the cost of each dose (\$25/vaccine) sold at a WNV vaccination clinic held in Loveland, Colorado in August 2002.<sup>6</sup>

Since the percentage of vaccinated equids within Colorado and Nebraska for 2002 is unknown, it is impossible to calculate the exact cost of prevention of WNV by vaccination. However, by assuming that various percentages of the equid population in the two States were vaccinated, it is possible to gain an appreciation of the potential magnitude of prevention costs. Determining the cost of prevention due to vaccination for equine WNV can be calculated by multiplying the estimated number of equids vaccinated within Colorado and Nebraska by the average cost of the two initial WNV vaccinations (\$50). The estimated total number of equids in Colorado and Nebraska on January 1, 1999, was 145,000 and 75,000, respectively. The estimated cost associated with vaccination of various percentages of equids with the initial two doses of WNV vaccine, using the cost of two vaccinations per equid, within Colorado and Nebraska is summarized in the table below.

State	Total # Equids	Cost of Initial Vaccine Series	Percent Equids Vaccinated	# Equids Vaccinated	Total Cost of Vaccination
Colorado	145,000	\$50	15	21,750	\$1,087,500
			25	36,250	\$1,812,500
			50	72,500	\$3,625,000
			75	108,750	\$5,437,500
Nebraska	75,000	\$50	15	11,250	\$562,500
			25	18,750	\$937,500
			50	37,500	\$1,875,000
			75	56,250	\$2,812,500

Approximately 47 percent of equine WNV cases in Colorado and Nebraska had received at least one WNV vaccination in 2002, based on the owner survey. If the percentage of equids fully vaccinated for WNV was slightly higher than that for the affected population, say 50 percent, vaccine expenditures would total \$5.5 million. If the percentage was lower, 25 percent, vaccine expenditures would be approximately \$2.75 million.

While vaccinating of equids against WNV accounts for a substantial portion of the total cost of prevention, other types of prevention need to be considered as well. Mosquito mitigation through insecticide spraying remains an effective preventive measure against the spread of WNV to humans, birds, and equids. Eliminating standing water on premises also is effective in reducing the mosquito population. Other preventative measures for reducing exposure to WNV include the use of insect repellents and decreasing equids' outdoor exposure to mosquitoes during dusk and dawn.

Although it is possible to calculate the cost associated with various forms of WNV prevention, the data from the survey of owners did not distinguish which prevention measures were in place to protect against WNV and which were aimed at preventing other diseases. Therefore, the costs of prevention other than vaccination are not included in this report.

## Summary

Clearly, WNV has had a marked impact on the Colorado and Nebraska equine industry. The estimated total cost attributed to death or euthanasia of equine WNV cases in Colorado and Nebraska equaled \$600,660. The estimated revenue lost by owners in Colorado and Nebraska because of lost-use associated with WNV was \$163,659. The estimated cost attributed to the treatment of mild, moderate, and severe WNV cases in Colorado and Nebraska equaled \$490,844. Because only laboratory confirmed cases were considered, it is important to note that the estimated values for these cost variables represent a conservative estimate of the actual cost of WNV to the equine industry. In addition to the costs specific to affected equids, prevention costs for

WNV vaccination were considered. Vaccination costs probably exceeded \$2.75 million in Colorado and Nebraska. Vector control costs directed at the prevention of WNV could not be estimated from the available data, but must be considered as further increasing the cost of WNV to Colorado and Nebraska equid owners.



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